T15D15 – 2011 IB HL Energetics Exam (FOR REVIEW)

For free response questions, the data booklet used will effect your answers for Bond energy problems, check work!

1. C
2. D
3. D
4. C
5. C
6. C
7. C
8. C
9. B

25. (a) ΔT = 23.70 – 23.03 = 0.67 (°C/K); 1

(b) $n = \left(\frac{0.4385\text{ g}}{342.34\text{ g mol}^{-1}}\right)$ = 1.281×10^{-3}; 1

(c) (i) $\Delta H_C = (C\,\Delta T)/n = \frac{-[(10.114\text{ kJ K}^{-1})(0.67\text{ K})]}{(1.281\times10^{-3}\text{ mol})}$ = -5.3×10^{3} kJ mol^{-1}; 1

Use ECF for values of ΔT and n.

(ii) Percentage experimental error = $\left[\frac{(-5.3\times10^{3})+(5.6\times10^{3})}{(-5.6\times10^{3})}\right]\times100$ = 5.4%; 1

Use ECF for values of ΔH_C.

(d) enthalpy change of combustion of sucrose > TNT, and therefore not important;
rate of reaction for TNT is greater than that of sucrose, so this is valid;
amount of gas generated (in mol) for sucrose > than that of TNT
(according to the given equation), so this is not important; 3

[7]

28. $-1\times\Delta H_1$/676;
$1\times\Delta H_2$/–394;
$2\times\Delta H_3$/– 484;
ΔH_4 = -202 (kJ mol^{-1}); 4

Accept alternative methods.
*Correct answers score **[4]**.*
*Award **[3]** for (+)202 or (+)40 (kJ/kJ mol^{-1}).*
-1(U) if units incorrect (ignore if absent).

[4]

29. (a) amount of energy needed to <u>break one mole</u> of (covalent) bonds;
in the <u>gaseous</u> state;
average calculated from a range of compounds; 2

*Award **[1]** each for any two points above.*

(b) bonds broken: 161 + 2×348 + 8×412 + 6×496/7580 kJ mol^{-1};
bonds made: 8×743 + 8×463/9648 kJ mol^{-1};
(bonds broken - bonds made =) ΔH = -2068(kJ mol^{-1}); 3

*Award **[3]** for the correct answer.*
Allow full ECF - 1 mistake equals 1 penalty.
Allow kJ but not other wrong units.

(c) same/equal, because the same bonds are being broken and formed; 1

(d) products more stable than reactants;
bonds are stronger in products than reactants/$H_P < H_R$/enthalpy/stored energy of products less than reactants; 2

[8]